

Claim Amendments

Claim 1 (original): A system for responding to file system requests having file IDs comprising V, a volume identifier specifying the file system being accessed, and R, an integer, specifying the file within the file system being accessed comprising:

D disk elements in which files are stored, where D is greater than or equal to 2 and is an integer;

a switching fabric connected to the D disk elements to route requests to a corresponding disk element; and

N network elements connected to the switching fabric, each network element having a mapping function that for every value of V, specifies one or more elements from the set D that store the data specified by volume V, where N is greater than or equal to 2 and is an integer and N + D is greater than or equal to 4, which receives the requests and causes the switching fabric to route the requests by their file ID according to the mapping function.

Claim 2 (original): A system as described in Claim 1 wherein each network element includes a translator which obtains file IDs from path names included in individual file system requests.

Claim 3 (original): A system as described in Claim 2 wherein each disk element and each network element has a file system location database which maintains a mapping from all file system identifiers V to disk element identifiers so each network element can translate each file system request ID into a corresponding disk element location.

Claim 4 (original): A system as described in Claim 3 wherein each disk element and each network element has a controller, and each disk element controller communicates with the network element controllers to identify which files are stored at the respective disk element.

Claim 5 (original): A system as described in Claim 4 wherein each network element can respond to any request for any disk element.

Claim 6 (original): A system as described in Claim 5 wherein each network element has a network port through which requests are received by the respective network element wherein all the network elements and disk elements together appear as a single system that can respond to any request at any network port of any network element.

Claim 7 (original): A system as described in Claim 6 wherein the disk elements form a cluster, with one of the disk elements being a cluster coordinator which communicates with each disk element in the cluster to collect from and distribute to the network elements which file systems are stored in each disk element of the cluster at predetermined times.

Claim 8 (original): A system as described in Claim 7 wherein the cluster coordinator determines if each disk element is operating properly and redistributes requests for any disk element that is not operating properly; and allocates virtual network interfaces to network elements and assigns responsibility for the virtual network interfaces to network elements for a failed network element.

Claim 9 (original): A system as described in Claim 8 wherein network elements and disk elements can be added dynamically.

Claim 10 (original): A system as described in Claim 9 wherein each network element advertises the virtual interfaces it supports to all disk elements.

Claim 11 (original): A system as described in Claim 10 wherein each disk element has all files with the same file system ID for one or more values of V.

Claim 12 (original): A system as described in Claim 11 wherein each request has an active disk element and a passive disk element associated with each request, wherein if the active disk element fails, the passive disk element is used to respond to the request.

Claim 13 (original): A system as described in Claim 11 wherein the requests include NFS requests.

Claim 14 (original): A system as described in Claim 13 wherein the requests include CIFS requests.

Claim 15 (original): A system as described in Claim 14 wherein the translator obtains the file IDs from path names contained within CIFS requests.

Claim 16 (original): A method for responding to file system requests comprising the steps of:

receiving file system requests having file IDs comprising V, a volume identifier specifying the file system being accessed, and R, an integer, specifying the file within the file system being accessed at network elements, each having a mapping function that for every value of V, specifies one or more elements from the set D that store the data specified by volume V; and

routing the requests to a switching fabric connected to the network elements based on the file system request's ID according to the mapping function to disk elements connected to the switching fabric.

Claim 17 (currently amended): A method as described in Claim 16 wherein the receiving step includes the step of obtaining the file ID from path names included in the requests with a translator of the network element.

Claim 18 (original): A method as described in Claim 17 wherein the routing step includes the step of maintaining all disk element locations at each file system location database of each disk element and each network element so each network element can translate each file system request ID into a corresponding disk element location.

Claim 19 (original): A method as described in Claim 18 wherein the receiving step includes the step of receiving requests at a network port of the network element which can respond to any request, and all the network elements and disk elements together appear as a single system.

Claim 20 (original): A method as described in Claim 19 wherein the routing step includes the step of collecting from and distributing to the disk elements and the network elements, which form a cluster, which file systems are stored in each disk element by a cluster coordinator, which is one of the disk elements of the cluster, at predetermined times.

Claim 21 (original): A method as described in Claim 20 wherein the routing step includes the step of redistributing requests from any disk elements which are not operating properly to disk elements which are operating properly by the network elements which receive the requests.

Claim 22 (original): A method as described in Claim 21 wherein after the routing step, there is the step of adding dynamically network elements and disk elements to the cluster so

the cluster appears as one server and any host connected to any network port can access any file located on any disk element.

Claim 23 (original): A method as described in Claim 22 wherein before the receiving step, there is the step of advertising by each network element each virtual interface it supports.

Claim 24 (original): A method as described in Claim 23 wherein the obtaining step includes the step of obtaining ID requests by the translator of the network element from path names contained in a CIFS request.

Claim 25 (original): A system for responding to file system requests having file IDs comprising V, a volume identifier specifying the file system being accessed, and R, an integer, specifying the file within the file system being accessed comprising:

D disk elements in which files are stored, where D is greater than or equal to 2 and is an integer;

a switching fabric connected to the D disk elements to route requests to a corresponding disk element; and

N network elements connected to the switching fabric, each network element having a mapping function that for every value of V, specifies one or more elements from the set D that store the data specified by volume V, where N is greater than or equal to 2 and is an integer and N + D is greater than or equal to 4, wherein network elements and disk elements can be added dynamically.

Claim 26 (original): A system for responding to file system requests having file IDs comprising V, a volume identifier specifying the file system being accessed, and R, an integer, specifying the file within the file system being accessed comprising:

D disk elements in which files are stored, where D is greater than or equal to 2 and is an integer;

a switching fabric connected to the D disk elements to route requests to a corresponding disk element; and

N network elements connected to the switching fabric, each network element having a mapping function that for every value of V, specifies one or more elements from the set D that store the data specified by volume V, where N is greater than or equal to 2 and is an integer and N + D is greater than or equal to 4, wherein each network element has a network port through which requests are received by the respective network element wherein all the network

elements and disk elements together appear as a single system that can respond to any request at any network port of any network element.

Claim 27 (new): A system for responding to file system requests comprising:

a plurality of network elements which receives the requests;

at least one switching element in communication with the network elements which route the requests; and

a plurality of disk elements in which files are stored and which respond to the requests in communication with the switching element.

Claim 28 (new): A system as described in Claim 27 including a plurality of switching elements in communication with the network elements and the disk elements which route the requests.

Claim 29 (new): A system as described in Claim 28 wherein each network element insures each request from the network element is only executed once.

Claim 30 (new): A system as described in Claim 29 wherein the network element retransmits the request for which the network element does not receive an acknowledgment from the switching elements.

Claim 31 (new): A system as described in Claim 30 wherein the network element authenticates the request.

Claim 32 (new): A system as described in Claim 31 wherein the network element parses the request.

Claim 33 (new): A system as described in Claim 32 wherein the network element parses the request into a sequence of file-level file system requests.

Claim 34 (new): A system as described in Claim 33 wherein the network element translates each request into a back plane file system protocol.

Claim 35 (new): A system as described in Claim 34 wherein the network elements, switching elements and disk elements are disposed in a server.

Claim 36 (new): A system as described in Claim 35 wherein the network element determines which disk element stores the file associated with each file request.

Claim 37 (new): A system as described in Claim 36 wherein the network element sends each request to the disk element having the associated file.

Claim 38 (new): A system as described in Claim 37 wherein the disk elements include directories whose contents implement a data structure that maps a file name within a directory into a file ID.

Claim 39 (new): A system as described in Claim 38 including a file system location data base.

Claim 40 (new): A system as described in Claim 39 wherein the network element interprets requests in POP, SMTP or IMAP protocols in terms of SpinFS operations.

Claim 41 (new): A system as described in Claim 40 wherein the network element issues look up requests for associated files in the disk elements.

Claim 42 (new): A system as described in Claim 41 wherein the network element issues read requests for associated files in the disk elements.

Claim 43 (new): A system as described in Claim 42 wherein the network element issues write requests to write the data into associated files.

Claim 44 (new): A system as described in Claim 43 wherein the network element issues create file requests to create a file in the disk elements.

Claim 45 (new): A system as described in Claim 44 wherein the network element issues create directory requests for associated files in the disk elements.

Claim 46 (new): A system as described in Claim 45 wherein the network element issues a remove a file request for an associated file in the disk elements.

Claim 47 (new): A system as described in Claim 46 wherein the network element issues a rename a file request for an associated file in the disk elements.

Claim 48 (new): A system as described in Claim 47 wherein the network element issues a request to lock a file from reading or writing with respect to the file.

Claim 49 (new): A system as described in Claim 48 wherein the disk elements form a cluster, with one of the disk elements being a cluster coordinator which communicates with each disk element in the cluster to collect from and distribute to the network elements which file systems are stored in each disk element of the cluster.

Claim 50 (new): A system as described in Claim 49 wherein the cluster coordinator determines if each disk element is operating properly and redistributes requests for

any disk element that is not operating properly; and allocates virtual network interfaces to network elements and assigns responsibility for the virtual network interfaces to network elements for a failed network element.

Claim 51 (new): A system as described in Claim 50 wherein each network element advertises the virtual interfaces it supports to all disk elements.

Claim 52 (new): A system as described in Claim 51 wherein each request has an active disk element and a passive disk element associated with each request, wherein if the active disk element fails, the passive disk element is used to respond to the request.

Claim 53 (new): A method for responding to file system requests comprising the steps of:

receiving each request at a network element of a plurality of network elements;

routing each request with at least one switching element in communication with the network elements; and

responding to each request with at least one disk element of a plurality of disk elements in which files are stored in communication with the switching element.

Claim 54 (new): A method as described in Claim 53 including the step of routing requests with a plurality of switching elements in communication with the network elements and the disk.

Claim 55 (new): A method as described in Claim 54 including the step of executing only once each request from the network element.

Claim 56 (new): A method as described in Claim 55 including the step of retransmitting by the network element each request for which the network element does not receive an acknowledgment from the switching elements.

Claim 57 (new): A method as described in Claim 56 including the step of authenticating each request with the network element.

Claim 58 (new): A method as described in Claim 57 including the step of parsing each request with the network element.

Claim 59 (new): A method as described in Claim 58 including the step of parsing each request into a sequence of file-level file method requests with the network element.

Claim 60 (new): A method as described in Claim 59 including the step of translating each request into a back plane file method protocol with the network element.

Claim 61 (new): A method as described in Claim 60 including the step of determining with the network element which disk element stores the file associated with each request.

Claim 62 (new): A method as described in Claim 61 including the step of sending each request with the network element to the disk element having the associated file.

Claim 63 (new): A method as described in Claim 62 wherein the disk elements include directories, and including the step of implementing a data structure that maps a file name within a directory into a file ID.

Claim 64 (new): A method as described in Claim 63 including the step of interpreting with the network element requests in POP, SMTP or IMAP protocols in terms of SpinFS operations.

Claim 65 (new): A method as described in Claim 64 including the step of issuing with the network element look up requests for associated files in the disk elements.

Claim 66 (new): A method as described in Claim 65 including the step of issuing with the network element read requests for associated files in the disk elements.

Claim 67 (new): A method as described in Claim 66 including the step of issuing with the network element write requests to write the data into associated files.

Claim 68 (new): A method as described in Claim 67 including the step of issuing with the network element create file requests to create a file in the disk elements.

Claim 69 (new): A method as described in Claim 68 including the step of issuing with the network element create directory requests for associated files in the disk elements.

Claim 70 (new): A method as described in Claim 69 including the step of issuing with the network element a remove a file request for an associated file in the disk elements.

Claim 71 (new): A method as described in Claim 70 including the step of issuing with the network element a rename a file request for an associated file in the disk elements.

Claim 72 (new): A method as described in Claim 71 including the step of issuing with the network element a request to lock a file from reading or writing with respect to the file.

Claim 73 (new): A method as described in Claim 72 including the step of forming a cluster with the disk elements, with one of the disk elements being a cluster coordinator which communicates with each disk element in the cluster to collect from and

distribute to the network elements which file methods are stored in each disk element of the cluster.

Claim 74 (new): A method as described in Claim 73 including the steps of determining with the cluster coordinator if each disk element is operating properly and redistributing requests for any disk element that is not operating properly; and allocating virtual network interfaces to network elements and assigning responsibility for the virtual network interfaces to network elements for a failed network element.

Claim 75 (new): A method as described in Claim 74 including the step of advertising by each network element the virtual interfaces it supports to all disk elements.

Claim 76 (new): A method as described in Claim 75 wherein each request has an active disk element and a passive disk element associated with each request, and including the step of responding with the passive disk element to the request if the active disk element fails.